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Abstract

Today, practitioners often have to face a number of challenges during the standardization of business processes, and some processes can be standardized easier (with less effort) than others. Our previous research has shown that major drivers of successful business process standardization are the characteristics respectively the complexity of a particular business process. In order to minimize standardization effort, we need an instrument that allows identifying processes which are appropriate for standardization by assessing each process' individual degree of complexity. On the way towards such an instrument, the first step is to develop an understanding of how the complexity of a business process affects its standardization. Therefore, the main aim of this paper is twofold: First, we provide a research model representing the fundamental relationships between our main constructs standardization effort, process complexity, and process standardization. Second, we report on the development of valid measurement scales designed to measure these constructs.

Keywords: Business Process Management, Business Process Standardization, Business Process Complexity, Standardization Effort, Items, Pre-test.

1 Introduction

Successful business process management (BPM) is one of the major keys for an organization to become a market leader within today's high competitive business environments (Laguna and Marklund 2005, Anupindi et al. 2006). Consequently, business process improvement continues to be the number one priority of CIOs worldwide (GartnerGroup 2010). A wide range of methods, policies, metrics, management practices, and technologies is available for managing and improving companies' processes continuously (Cantara and Hill 2008). One possible action to increase the performance of a given process is standardization (Swaminathan 2001, Lillrank 2003, Anupindi et al. 2006, Muenstermann et al. 2010). *Process standardization* offers many benefits and opportunities for performance improvement, for example, increases in operative process performance, cost savings, and increasing profit due to efficiency, transparency and controllability, quality, cost degression, and decreasing risks (Davenport 1993, Hammer and Champy 1993, Juran and Godfrey 2000, Swaminathan 2001, Ramakumar and Cooper 2004, Thawani 2004, Dedhia 2005, Anupindi et al. 2006, Wüllenweber et al. 2008, Muenstermann et al. 2010). Due to these obvious advantages, companies increasingly seek to achieve operational excellence by standardizing processes (Davenport 2005).

However, process standardization is easier said than done. During standardization initiatives, practitioners face a number of challenges (Rosenkranz et al. 2010). For example, process standardization currently is only well understood for manufacturing industries, where assembly line production is typical that is characterized by highly repetitive processes. Today's value creation, however, is increasingly dominated by the service sector (Spohrer and Maglio 2010). Essentially, services revolve around interactions of humans (Chase and Dasu 2001). Human performance can be enhanced by technical artifacts (Oliva and Sterman 2001), but the interactions are still the key: raising the productivity of employees whose jobs cannot be automated is identified as one of the next great performance challenges (Johnson et al. 2005). Moreover, as inter-organizational networks become ever more important for value creation, processes cut across inter-organizational boundaries and functions (Kock and McQueen 1996). All of this makes the individual development and successful implementation of standardized processes a cumbersome challenge (Davenport and Prusak 1998). As a result, some processes can be standardized easier (with less effort) than others. Consequently, process standardization as a much-discussed problem among researchers as well as practitioners is identified as a "broad future research direction" (Venkatesh 2006).

Previous research has shown that especially *complexity* renders it difficult to establish rules, procedures, and responses to potential problems (Daft and Macintosh 1981, Mani et al. 2010). With rising process complexity, standardization of processes is harder to achieve and more effort needs to be spent in standardization initiatives. At a certain level of process complexity, it is almost impossible to predefine all possible workflows (Sackmann 2008). From an economic point of view, given a limited set of resources in time, money, and employees, we claim that not all processes can be standardized to the same extent due to their inherent complexity. In order to avoid useless "overstandardization", we aim to separate standard processes from complex processes by using process-inherent characteristics. Therefore, the main aim of this paper is twofold: First, we provide a research model representing the fundamental relationships between our main constructs standardization effort, process complexity, and process standardization. Second, we report on the development of valid measurement scales designed to measure our constructs.

The remainder of this paper is structured as follows. We discuss the theoretical foundation of our research in Section 2. Following this, we outline our research model in Section 3. We support and discuss our model in relation to previous research findings. This leads us to a set of hypotheses. Afterwards, we present scale creation and measurement development for our main constructs in Section 4. Subsequently, we discuss the contributions and limitations of our research in Section 5 before we finally summarize the findings in Section 6 and give an outlook on further research.

2 Theoretical Background on Business Process Complexity

The definition of complexity is the subject of vigorous, sometimes strident debate (Rivkin 2001). Complexity is a multi-facetted term which has many possible meanings and is inherently subjective (Flood and Carson 1993). Generally, complexity can be described as a measure of how understandable a system is and how difficult it is to perform tasks in the system (Ranganathan and Campbell 2007). In the same way, complexity is a fundamentally qualitative concept, though several attempts have been made by various researchers to provide a more or less useful and general quantitative definition (Backlund 2002). Due to its subjective and qualitative nature, it is difficult to exactly determine what constitutes complexity. Then how can we measure the complexity of a business process? Consequently, the main challenges within our research are, first, to develop measures of process complexity and, second, to show that and how process complexity influences process standardization.

In the context of BPM, we understand *process standardization* as the unification of business processes and the underlying actions within an organization in order to "facilitate communications about how the business operates, to enable handoffs across process boundaries in terms of information, and to improve collaboration and develop comparative measures of process performance" (Davenport 2005). Thus, the objective of process standardization is to specify transparent and uniform process activities across the organization or value chain and across firm boundaries (Wüllenweber et al. 2008). The intention is to create a time-, cost-, and quality-optimal way of achieving the business process' goal (Muenstermann et al. 2010). A business process, the object of process standardization, is generally understood as a sequence of actions, carried out by actors or IT, by which organizations transform inputs into outputs (Davenport 1993, Lillrank 2003, Pentland 2003). Business processes cut horizontally across the organization and create an interrelated organizational subsystem that forms a micro-structure of related tasks, technology, and people (Kettinger and Grover 1995). Therefore business processes cover a wide range of activities within an organization. The spectrum ranges from iterative, simple or knowledge-intensive up to complex, creative, and unique business processes.

In this context it is crucial to divide between 'standard processes' and 'standard*ized* processes'. A *standard process* exhibits predetermined input, produces an ex-ante specified output, and is repeated identically. Standard processes are predestined for being exactly defined and standardized (Lillrank 2003). However, they only offer this potential and may *not* be standardized, yet. Standard processes are simple: events and outcomes are well-understood; the process can be designed to accept a specified type of input, and to produce an ex-ante specified type of output, and process control is realizable by following established standard procedures and process descriptions (Powell et al. 2001, Anupindi et al. 2006). That is, standard processes follow a binary logic (Mason 1978, Lillrank and Liukko 2004). They are identical, mindless repetitions or activities following scripts in order to achieve a specified target. In summary, their content variety is determined (Lillrank 2003), which means that every activity can be processed each time in an optimal way. The task of management is to determine the best way of execution and to turn standard processes into standardized processes using standard operating procedures, which are obligatory to all actors in an organization (Lillrank and Liukko 2004). A process is only successfully standardized if it is executed each time in a predefined (optimal) way by processing the same activities in the same order and producing exactly the same previously specified output. Besides standard processes, two additional types of business processes exist: routines and nonroutines (Lillrank 2003, Lillrank and Liukko 2004). A *routine process* can have two or more types of inputs, and two or more types of alternative outputs (Mason 1978, Lillrank and Liukko 2004). Differences in the sequences of a business process arise due to variability in the work processes. The assessment of a routine process cannot be reduced to a binary logic. The input of a routine must be interpreted and classified before a finite set of actions and algorithms can be selected (Lillrank 2003, Lillrank and Liukko 2004). The overall aim of a routine is usually clear, but can be achieved through different types of actions. In contrast to standard processes, routines show some uncertainties concerning the process execution. Therefore experienced employees are needed that are capable to assess and classify the incoming inputs and afterwards to select an appropriate action

(Lillrank 2003). A *nonroutine process* is characterized by an unknown or vague set of inputs and outputs (Lillrank and Liukko 2004). Since input is not known ex-ante, it cannot be linked with specific actions or algorithms. The input variety set is larger than the experience set employed by the process (Lillrank 2003). This uncertainty of process inputs may only be anticipated through highly skilled or experienced employees (experts) who develop new knowledge and heuristics in order to accomplish the process. Consequently, employees for the most part have to apply tacit knowledge, which would be economically senseless to be explicated in form of a model or process documentation (Davenport and Prusak 1998). To sum up, routines and nonroutines show a higher complexity than standard processes and can only be standardized to some degree (or even not at all). (See Rosenkranz et al. (2010) and Schäfermeyer et al. (2010) for a summary of the different types and characteristics of processes).

Within previous work, we categorized business processes that were subject to standardization effort according to the three types within different case study settings (Rosenkranz et al. 2010, Schäfermeyer et al. 2010). Due to the different types of business processes, it was not surprising to see that the case organizations differed in the way they managed their standardization initiatives, on which level of detail they (re-) designed their processes, and what extent of resource commitment was involved. Furthermore, some of the organizations were more successful in process standardization than others. The effort invested in process standardization varied between the organizations depending on the predominant business process type. To sum up, we argue that managers need to identify and separate standard processes from routine and nonroutine processes in order to focus their standardization efforts on the right kind of business processes, not wasting efforts on non-standardizable processes. Dealing with (non-) routines calls for the development of other BPM methods and measures because process standardization is not achievable in those cases. We propose that the nature of a business process allows assigning it to one of the three types by assessing its individual characteristics. The main difference between the types is that each of them represents another level of process complexity: a standard process represents the lowest level of process complexity whereas a nonroutine exhibits the highest level.

3 Deriving the Research Model

One of the leading goals of this research is to explain how the relationship between standardization effort and process standardization is moderated by process complexity. Our main intention in this paper is to build valid knowledge claims that explain why something occurred by means of a dependent variable (i. e., process standardization) in the context of specific conditions described via the use of independent or mediating variables (i. e., standardization effort and process complexity) (Tan et al. 2008). Therefore we develop and present a new research model which illustrates and generalizes the key findings and relationships that we discussed in Section 2. This model has to be validated empirically in the future. Figure 1 summarizes the model, the main constructs, and the relationships which are explained and derived in more detail below.

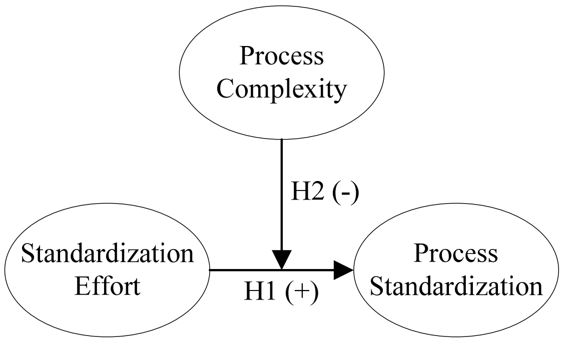

Figure 1. Research Model

First, we define the dependent variable "process standardization". In addition to the definitions given in Section 2 we refer to Muenstermann et al. (2010) who analyzed the positive effect of process standardization on process performance. They define process standardization as "the unification of variants of a given business process by aligning the variants against an archetype process". This definition highlights the aligning character during the process of standardization and is compatible with our understanding given above. We emphasize this alignment process because the main challenge during standardization initiatives is to turn existing process variants into standard operating procedures that are obligatory to all actors in an organization (Lillrank and Liukko 2004). Summing up, we combine the definitions and specify *process standardization* as

> *the unification of variants of a given business process by aligning the variants against an archetype process that results in transparent and uniform process activities specified in standard operating procedures which are obligatory to all actors in an organization in order to create a time-, cost-, and quality-optimal way of achieving the business process' goal.*

Next, we specify the independent variable "standardization effort". The measurement of effort is problematic because no generally accepted instrument for effort assessment exists (Green and McIntosh 2001). In general, effort can be understood as both a subjective as well as an objective construct. Brown et al. (1997), for example, measure effort by asking their survey partners to rate how much time, work intensity, and overall effort they intended to put into their work. On the contrary, effort is often quantified as the amount of a spent resource in relation to time. Therefore effort is often presented in terms of staff hours, staff days, or even staff months. This duality is manifesting itself also within the IS literature. Swanson and Dans (2000), for example, examine the relationship between the life expectancy of an IS and its maintenance effort. Within their study, they define effort as the number of (maintenance) staff assigned to the IS, using full-time equivalents (FTE) to quantify it (Swanson and Danes 2000). In contrast, Lilien et al. (2004) focus on the process by which model-based decision support systems influence managerial decision making (e. g., cognitive effort deployed). They define cognitive effort as "the self-reported extent of mental effort deployed by the subject in making the decisions".

Transferred to a BPM context, we argue that standardization effort can be measured best if we take into account, on the one hand, the subjective effort deployed by process managers and, on the other hand, the invested and objectively measured resources. Measuring only the amount of resources expended on a particular job is too vague to cover all dimensions of effort (De Cooman et al. 2009). With regard to our model and the BPM domain, we define *standardization effort* as

> *the sum of the resources spent as subjectively perceived and objectively measured in order to create a standardized business process within an organization.*

As this definition highlights, we focus on effort invested for what Davenport (2005) defines as *intra-company* process standardization. Intra-company standardization intends to improve the performance and business operations within a special company. It has to be separated from *inter-company* process standardization where process standardization is performed across companies (Davenport 2005). This distinction is important because the amount of invested standardization effort depends on whether process standardization is intra- or inter-company. Here, our intention is to measure a company's effort invested for the standardization of intra-company business processes. A main finding supported by our previous case studies, although obvious, is that the amount of standardization effort has a positive effect on business process standardization. Our results showed that the more a company invested in terms of standardization effort, the more process standardization was achieved. Therefore, we suppose that with increasing standardization effort an organization's process standardization will increase and propose our first hypothesis (H1 in Figure 1):

Hypothesis 1: *Process standardization effort is positively associated with process standardization.*

As the discussion in Section 2 has shown, the complexity of a business process is an important antecedent for process standardization. Rivkin (2001) defines complexity as having two important aspects: a productive system is complex if (1) it consists of numerous elements and (2) those elements interact with one another richly. Likewise, Schneberger and McLean (2003) or Ribbers and Schoo (2002) characterize complexity as a function of the number and variety of components and their interactions and the rate of change. If all of this is true, the process characteristics belonging to the three process types discussed in Section 2 can be understood as a first set of items suitable to measure process complexity. Hence we define *process complexity* as

> *a function of the number and variety of all activities forming the business process, their interrelations and dynamics. The inherent characteristics of a business process build its complexity. From a subjective perspective process complexity is a measure for the self-reported difficulty faced by process managers and executioners that is caused by process-inherent characteristics.*

The definition emphasizes that complexity also is a subjective construct, which can individually be measured by assigning a process to one of the three process types via the assessment of the individual processes characteristics. When rethinking our previous case studies, it becomes apparent that the complexity of a business process moderates the effect of standardization effort on process standardization (see Rosenkranz et al. 2010, Schäfermeyer et al. 2010). Summing up, we expect that process complexity as a moderator modifies the effects of standardization effort on process standardization (H2 in Figure 1). The relationship between standardization effort and process standardization is attenuated as an organization's processes show high process complexity:

Hypothesis 2: *With higher process complexity the effect of standardization effort on process standardization will be attenuated.*

This means that during the standardization of a business process with low complexity, the positive effect of the invested standardization effort on process standardization will be the greatest. In other words, the standardization of a simple (standard) business process will be achievable with low effort. In contrast, if a (nonroutine) business process with high complexity is to be standardized, the invested standardization effort will increase and the resulting degree of process standardization might be low or even unachievable.

We are aware that the research model and especially hypothesis 1 seem obvious. But a model that is parsimonious and simple can have tremendous impact on research. The long-term goal of our research is the development of a valid and reliable measurement instrument for the moderating construct process complexity. This is obviously in demand and need by BPM practitioners. For this, the empirical validation of our research model is essential. Having a measurement scale for assessing process complexity in order to identify standardizable business processes would provide an enormous benefit.

4 Measurement Scale Development

Only adequately measured variables can be used to identify significant relationships between those variables (O'Leary-Kelly and Vokurka 1998). To ensure validity of our measures we carefully designed our items by adopting items from existing surveys and under the consideration of our construct definitions. Existing measurement scales where not blindly adapted to the context of business process standardization, as their appropriateness for our research domain must be demonstrated first. For the two constructs standardization effort and process standardization, we adopt items previously used in other surveys and customize them to the domain of process standardization. To our knowledge no measurement scales to assess business process complexity exist. Therefore we also discuss the development of a new multi-item measurement scale for the process complexity construct. Our development follows established guidelines (Moore and Benbasat 1991). A pilot test of the developed scales inventory with a small sample of BPM experts is not part of this paper but will be carried out as the next step in our research. Table 1 summarizes the items for every construct and states the relevant literature we used for item development.

For the construct *process standardization* we adopt the four items (PS 1 – PS 4) Muenstermann et al. (2010) developed to measure process standardization within their survey. Due to the fact that Muenstermann et al. (2010) had a special focus on staff recruitment processes within their study, we modify the original items in order to give them a wider scope. The main intention here is to make the items usable to measure the standardization of any process within any organization.

Construct	No	Item definition	Reference
Process standardization	PS 1	During the execution of the business process we follow a well-regulated process cycle.	Muenstermann et al. 2010
	PS 2	The business process is efficiently organized.	
	PS 3	The execution of the business process is strongly standardized.	
	PS 4	We have documented all actions of the business process to a great extent.	
Standardization effort	SE 1	The standardization of the business process is very time-consuming.	Brown et al. 1997
	SE 2	The standardization of the business process is very labor-intensive.	
	SE 3	The standardization of the business process is accompanied by a very high overall effort.	
	SE 4	The standardization of the business process employs ___ full time euquivalents (FTE).	Swanson & Danes 2000
	SE 5	In total the standardization of the business process requires ___ person-month.	
	SE 6	All involved employees are totally immersed in the standardization of the business process.	Lilien et al. 2004
	SE 7	We put a lot of effort in the standardization of the business process.	
Process complexity	PC 1	The set of inputs necessary for process execution differ often.	Lillrank 2003, Lillrank & Liukko 2004, Pentland 2003
	PC 2	Even without standardization activities the business process is always characterized by the same output.	
	PC 3	Basically, even without standardization activities the business process is always characterized by the same sequence of activities.	Pentland 2003
	PC 4	The procedure of the business process never repeats identically.	Lillrank 2003
	PC 5	The business process is characterized by uncertainty.	Lillrank & Liukko 2004
	PC 6	Because of its characteristics the business process can be controlled by means of specifications, models, manuals, or statistical process control.	Lillrank 2003
	PC 7	The employees executing the business process need no experience with the process.	
	PC 8	The employees executing the business process need to be able to flexible adjust themselves to the differing process sequences.	Pentland & Reuter 1994

Table 1. List of Items by Construct

To cover the subjective as well as objective dimensions of *standardization effort* we conceptualize the construct by the use of seven items (SE 1 – SE 7). The first three items (SE 1, SE 2, SE 3) are adopted from Brown et al. (1997) and items SE 6 and SE 7 are originally developed by Lilien et al. (2004). They measure the subjective perception of the effort invested in process standardization. We rearranged the wording in order to make the items capable to measure the invested standardization effort of process managers. Additionally, we include items SE 4 and SE 5 in order to consider the objective dimension of the standardization effort construct. Item SE 4 was adapted from Swanson and Danes (2000) and adjusted to objectively measure standardization effort by the usage of FTE. Based on this, we derived item SE 5, as it is general practice within organizations to measure effort in person-month.

Finally, we used the process characteristics described in Rosenkranz et al. (2010) and Schäfermeyer et al. (2010) to derive a first set of items for the construct *process complexity*. In order to ensure content validity, we discussed each of the characteristics with three process managers from two different organizations within semi-structured interviews. This finally led us to a set consisting of eight items (PC 1 – PC 8). Five of the original characteristics (acceptance criteria, input assessment, conversion rules, logic, and type of knowledge) were excluded in order to avoid confusion because their assessment within a survey would be problematic and, as the process managers confirmed, “difficult to answer properly”. Furthermore, we discussed the appropriateness of all construct definitions as well as the items of the other two constructs with the interviewees. Here, the process managers agreed with every definition and item. In order to guarantee construct validity of the candidate items and to identify poorly worded or ambiguous items we asked 35 BPM experts to sort the items summarized in Table 1 into the three construct categories. The panel consisted of academic staff conducting research within the BPM domain as well as experienced process managers from practice. First, in order to ensure comprehensibility, the three panel members whom we interviewed face-to-face were asked to perform the categorization task and report on problems with given instructions and testing procedures.

Afterwards, we distributed the reviewed form via e-mail within three phases to the remaining 32 panel members. After each phase items were reworded if necessary before the next sorting round started. Table 2 depicts the number of experts asked in every phase and overall as well as some descriptive statistics about their qualification.

	1st round			2nd round			3rd round			Overall		
	Average (years)	Minimum (years)	Maximum (years)	Average (years)	Minimum (years)	Maximum (years)	Average (years)	Minimum (years)	Maximum (years)	Average (years)	Minimum (years)	Maximum (years)
Company affiliation	5.92	1.5	10	10.19	1.5	24	6.55	2	15	8.31	1.5	24
Exercise of profession	6.58	2	12	12.86	2	24	5.91	2	15	9.60	2	24
Experience in BPM	7.58	2	12	6.97	2	16	5.09	1	13	6.49	1	16
Number of respondents		6			18			11			35	

Table 2. Expert Qualification per Phase

We use a pre-test assessment of the measures' substantive validities in order to predict the measures' performance (Anderson and Gerbing 1991). Substantive validity of a measure is a major prerequisite for construct validity. Furthermore, the small-sample nature of substantive validity assessments make them particularly well suited for pre-tests. The basis for substantive validity assessment is an item-sort task during which respondents are asked to assign each item to the construct that, in their judgment, the item indicates best. For analyzing the data across all judges, two indices of substantive validity are proposed. The first index calculates the *proportion of substantive agreement*, P_{SA}, which is defined as the extent to which an item reflects its intended construct. However, the P_{SA} index does not indicate the extent to which an item might also reflect other, unintended constructs. Therefore a second index is applied: the *substantive validity coefficient*, C_{SV}, represents the extent to which respondents assign an item to its posited construct more than to any other construct. Values range from 0.0 to 1.0 for P_{SA} and from -1.0 to 1.0 for C_{SV}. For both indices a larger value indicates a greater substantive validity, whereas 0.5 is a recommended threshold for the C_{SV} index (Anderson and Gerbing 1991).

In the first phase we asked six experts to complete the sorting task and to report on poor wording, odd sentences, and misleading formulations. As Table 3 shows, all P_{SA} and C_{SV} indices showed very good results for all items of the process standardization and standardization effort constructs. For process complexity three out of our eight developed items showed low values of substantive validity (PC 2, PC 3, PC 6). This was due to the fact, that some of the respondents linked these items to the process standardization construct. Therefore we reworded these items and started phase two. In the second round we asked 18 experts to complete the sorting task. Again, the items measuring process standardization showed high values of substantive validity. For the standardization effort construct nearly all items reached satisfactory results. But the results for item SE 6 got worse drastically compared to the first phase, which was due to the fact that 9 of the 18 experts assigned item SE 6 to the process standardization construct. For the construct of process complexity, the rewording of PC 2, PC 3, and PC 6 has only a slightly positive effect on item PC 2, whereas the results for PC 3 and PC 6 impaired. The items were still categorized to indicate process standardization too often. Additionally, the C_{SV} value of PC 7 had fallen below the 0.5 threshold, due to five expert-assignments to the process standardization construct. Therefore we reworked and discussed the wording of PC 2, PC 3, and PC 6 with two experts. As PC 7 reached the value of 1.0 for both indices in the first round, we decided not to rework the wording of this item because its C_{SV} values were not as bad as those of the others. We did the same for SE 6 because slight fluctuations between each round could also be caused by the differing composition of the expert pool. We conducted a third round with 11 experts in order to test the new wording of items PC 2, PC 3, and PC 6 and to control the values of items SE 6 and PC 7. As Table 3 shows, the values for PC 2 and PC 3 improved dramatically compared to both previous phases and indicate the success of our rewording. Even the values of PC 6 (P_{SA}=0.64; C_{SV}=0.27) increased. As expected, the substantive validity of SE 6 improved and ranges on a similar level as in the first phase. Summing up, we decided to not reject any item due to either the improvements in substantive validity within the third round or random fluctuations. Aggregated over all three rounds, only four items (SE 6, PC 2, PC 3, PC 6) do not pass the 0.5-treshold of the C_{SV} index. But as, for example, PC 3 showed perfect substantive validity (P_{SA}=1.0; C_{SV}=1.0) after the rewording in the third round, we decided not to exclude it.

Construct	Item	1st round		2nd round		3rd round		Overall	
		P_{SA}	C_{SV}	P_{SA}	C_{SV}	P_{SA}	C_{SV}	P_{SA}	C_{SV}
Process standardization	PS 1	1	1	1	1	1	1	1	1
	PS 2	0.83	0.67	0.94	0.89	0.91	0.82	0.91	0.86
	PS 3	1	1	0.89	0.78	1	1	0.94	0.89
	PS 4	0.83	0.67	0.89	0.78	0.91	0.82	0.89	0.77
Standardization effort	SE 1	1	1	1	1	1	1	1	1
	SE 2	1	1	0.94	0.89	1	1	0.97	0.94
	SE 3	1	1	0.94	0.89	1	1	0.97	0.94
	SE 4	1	1	1	1	1	1	1	1
	SE 5	1	1	1	1	1	1	1	1
	SE 6	0.83	0.67	0.5	0	0.73	0.45	0.63	0.26
	SE 7	0.83	0.67	1	0.94	1	1	0.97	0.94
Process complexity	PC 1	1	1	1	1	1	1	1	1
	PC 2	0.5	0	0.67	0.33	0.91	0.82	0.71	0.43
	PC 3	0.67	0.33	0.33	-0.33	1	1	0.6	0.2
	PC 4	0.83	0.67	0.89	0.78	0.82	0.73	0.86	0.77
	PC 5	0.83	0.67	0.94	0.89	1	1	0.94	0.91
	PC 6	0.33	-0.17	0.28	-0.28	0.64	0.27	0.4	-0.09
	PC 7	1	1	0.67	0.39	0.73	0.55	0.74	0.54
	PC 8	1	1	0.83	0.72	0.64	0.36	0.80	0.66

Table 3. Substantive Validity Pre-test per Item

Additionally, as shown in Table 4, all constructs pass the 0.5-threshold with aggregated item values. Furthermore, as Table 4 displays both indices for substantive validity aggregated per construct, it shows that our items improved continuously with every sorting-round and finally reached very satisfactory results in the third round. The high P_{SA} and C_{SV} values within this phase indicate that the items finally measure the underlying constructs quite well.

Construct	# Items	1st round		2nd round		3rd round		Overall	
		P_{SA}	C_{SV}	P_{SA}	C_{SV}	P_{SA}	C_{SV}	P_{SA}	C_{SV}
Process standardization	4	0.92	0.83	0.93	0.86	0.95	0.91	0.94	0.88
Standardization effort	7	0.95	0.90	0.91	0.82	0.96	0.92	0.93	0.87
Process complexity	8	0.77	0.56	0.70	0.44	0.84	0.72	0.76	0.55

Table 4. Substantive Validity Pre-test Aggregated per Construct

5 Discussion

Currently, the exact nature of the relationship between standardization effort and process standardization is poorly understood within the BPM domain. Moderating and mediating factors that drive or inhibit process standardization remain largely unexplained. Therefore, the research model that we derived and discussed in this paper is a first building block for knowledge on successful and efficient process standardization. We argue that process complexity as a moderator is the major variable process managers need to consider when deciding on which processes their standardization efforts should be focused on. Especially the development of a measurement scale for the process complexity construct can be seen as promising step towards an instrument allowing process managers to assess the complexity of any business process. We are convinced that this will help process managers to make cost-efficient decisions and prevent organizations from wasted efforts created by the futile attempt to standardize almost all business processes, even complex nonroutines. Overall, with this simple but coherent model and the outlined instrument development research, we offer several contributions. We provide a conceptualization that explains the moderating role of process complexity. This is a major benefit for both researchers and practitioners. It is important for BPM research, as to the best of our knowledge, no empirical validated measurement model for process complexity exists to date. This instrument is useful in a variety of related research fields. For example, there are different streams of technical research that relate to process complexity: schema integration (Giunchiglia et al. 2007), process model integration (Dijkman 2008), or modeling process variants (Rosemann and van der Aalst 2007). Altogether, the challenges in this area relate to the identification of correspondences and to the integration of process models. Here, the identification of complex processes could be of tremendous help. Moreover, the complexity of business processes is widely considered to be a major inhibitor of business process outsourcing (Mani et al. 2010) and further constitutes a crucial element in post merger integrations (Wijnhoven et al. 2006), where eliminating redundancies is a central motivation (Håkanson 1995). Having a valid and reliable instrument for assessing business process complexity and therefore enabling process managers to identify and concentrate standardization efforts, outsourcing efforts, or merger efforts on standardizable business processes would ensure an enormous benefit and increase of efficiency in BPM practice.

Of course our study has several limitations. First, the underlying case studies have been exploratory and are not a validation of the proposed research model. Second, the measurement scales development process described in this paper is not complete, yet. Without the pilot test and the testing of the overall questionnaire only initial indications of validity could be achieved. Therefore, our research model needs to be tested and empirically corroborated on a large scale. We plan to continue our rigorous analysis and test our research model via structural equation modeling. Nevertheless, if “sound” BPM and successful process standardization are among the desired goals, researchers and practitioners may benefit from our insights on what kind of activities strengthen or threaten the relationship between process standardization effort and process standardization.

6 Conclusion

In this paper, we have described and discussed the theoretical conceptualization of a research model in order to understand how process complexity influences the relationship between standardization effort and process standardization. The model, its constructs and hypotheses have been thoroughly derived by integrating components of theories from different approaches and areas of research as well as findings from previous exploratory case studies. Furthermore, we developed measurement scales for our constructs by passing a multistage process during which successful tests for substantive validity could be applied. This pre-test indicates that all items of the measurement scales reflect the underlying constructs well. Here, especially the measurement scales of the standardization effort construct derived by combination of existing scales as well as the new development of the measurement instrument for process complexity are a novelty for the domain of process standardization. Next, we will conduct a pilot test of our measurement scales and constructs to prove reliability and validity. Afterwards, our scale inventories can be used to test our model within a wide-ranging survey among BPM experts and carefully investigate the moderating effect of process complexity.

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